WE CLAIM:

1. A turbine component comprising:

an integral ring of single crystal turbine airfoils;

wherein each airfoil has a defined primary (radial) and secondary (axial) crystal orientation; and

a defined crystallographic mismatch between adjacent single crystal turbine airfoils.

2. The turbine component of claim 1, wherein the turbine component has anisotropic properties.

3. The turbine component of claim 1, wherein grain boundary misorientations between adjacent single crystal turbine airfoils are as high as about 18.0 degrees.

4. The turbine component of claim 1, wherein the turbine component comprises a nozzle.

5. The turbine component of claim 1, wherein the turbine component comprises a bladed turbine disk.

6. The turbine component of claim 1, wherein the turbine component comprises a thermal barrier coating.

7. The turbine component of claim 5, wherein a primary [100] orientation of each single crystal blade is approximately aligned with the radius of the bladed ring.

8. The turbine component of claim 5, wherein a secondary [001] orientation of at each single crystal turbine airfoil is approximately parallel to the trailing edge of each single crystal turbine airfoil.

9. A turbine component comprising:

an integral ring of single crystal turbine airfoils;

wherein the average crystallographic orientation changes between adjacent single crystal turbine airfoils by 360/n degrees, where *n* is the number of single crystal turbine airfoils.

10. The turbine component of claim 9, wherein the turbine component has anisotropic properties.

11. The turbine component of claim 9, wherein the change in crystallographic orientation, between adjacent single crystal airfoils, does not exceed three degrees, in either direction, from the average crystallographic orientation of 360/n.

12. The turbine component of claim 9, wherein the turbine component comprises a nozzle.

13. The turbine component of claim 9, wherein the turbine component comprises a bladed turbine disk.

14. The turbine component of claim 9, wherein the turbine component comprises a thermal barrier coating.

15. The turbine component of claim 13, wherein a primary [100] orientation of each single crystal blade is approximately aligned with the radius of the bladed disk.

16. The turbine component of claim 13, wherein a secondary [001] orientation of each single crystal turbine airfoil is approximately parallel to the trailing edge of the single crystal turbine airfoil.

17. The turbine component of claim 13, wherein a secondary [001] orientation of the airfoils is approximately parallel to the integral ring axis.

18. The turbine component of claim 13, wherein a primary [100] orientation of each single crystal turbine airfoil is aligned with the radius of the bladed ring.

19. The turbine component of claim 16, wherein the secondary [001] orientation of each single crystal turbine airfoil is parallel to the trailing edge of the single crystal turbine airfoil.

20. A turbine component comprising:

an integral ring of single crystal turbine airfoils;

wherein the crystallographic orientation changes between adjacent single crystal turbine airfoils alternate from zero degrees to approximately 360/(0.5n) degrees, where *n* is the number of single crystal turbine airfoils.

21. The turbine component of claim 20, wherein the turbine component has anisotropic properties.

22. The turbine component of claim 20, wherein the turbine component comprises a nozzle.

23. The turbine component of claim 20, wherein the turbine component comprises a bladed turbine disk.

24. The turbine component of claim 20, wherein the turbine component comprises a thermal barrier coating.

25. The turbine component of claim 23, wherein a primary [100] orientation of each single crystal blade is approximately aligned with the radius of the bladed disk.

26. The turbine component of claim 23, wherein a secondary [001] orientation of each single crystal turbine airfoil is approximately parallel to the trailing edge of the single crystal turbine airfoil.

27. The turbine component of claim 23, wherein a secondary [001] orientation of the airfoils is approximately parallel to the integral ring axis.

28. An integral ring of single crystal turbine airfoils manufactured by:

(a) positioning doubly oriented single crystal superalloy seed crystals into a desired orientation into a chilled base of an investment casting mold;

(b) preheating the portion of the mold containing a pour cup, gating, blade ring pattern, and grain bridges, to a temperature above the liquidus of the single crystal superalloy;

(c) maintaining the chilled surface of the single crystal superalloy seed crystals at a temperature below the solidus temperature of the superalloy;

(d) casting into the investment casting mold molten superalloy at a temperature above the liquidus temperature of the superalloy;

(e) establishing a thermal gradient, such that temperature increases from said superalloy seed crystals through the molten superalloy; and

(f) moving the thermal gradient vertically through the investment casting mold to directionally solidify the superalloy within the integral ring in the axial direction.

29. The turbine component of claim 28, wherein the turbine component has anisotropic properties.

30. The turbine component of claim 28, where adjacent airfoils have grain boundary misorientations as high as about 18.0 degrees.

31. The integral ring of single crystal turbine airfoils of claim 28, wherein the single crystal superalloy seed crystals comprise nickel or a nickel-based superalloy.

32. The ring of turbine airfoils of claim 28, wherein the single crystal superalloy composition comprises of 61.41 weight percent nickel, 9.3 weight percent cobalt, 5.0 weight percent chromium, 8.6 weight percent tungsten, 4.5 weight percent tantalum, 0.7 weight percent molybdenum, 3.0 percent rhenium, 5.7 weight percent aluminum, 0.7 weight percent titanium, 1.0 weight percent hafnium, 0.07 weight percent carbon, 0.015 weight percent boron, and 0.005 weight percent zirconium.

33. A method for manufacturing an integral ring of single crystal turbine airfoils, comprising:

(a) positioning doubly oriented superalloy seed crystals into the desired orientation into a chilled base of an investment casting mold;

(b) preheating the portion of the mold containing the pour cup, gating (passages from the pour cup to the integral ring), blade ring pattern, and grain bridges (passages from the blade ring pattern to the seed crystals) to a temperature above the liquidus of the single crystal alloy; during preheating the

chilled surface of the superalloy seed crystals is maintained at a temperature below the solidus temperature of the metal;

(c) casting into the investment casting mold molten superalloy at a temperature above the liquidus temperature of the metal;

(d) establishing a thermal gradient, such that temperature increases from said superalloy seed crystals through said molten superalloy; and

(e) moving the thermal gradient vertically through the mold to directionally solidify the superalloy within the integral ring in the axial direction.

34. The method of claim 33, wherein step (e) comprises removing the turbine integral ring vertically out of the mold heater.

35. A method for manufacturing a single crystal bladed turbine disk, comprising:

(a) positioning doubly oriented superalloy seed crystals into the desired orientation into the chilled base of an investment casting mold;

(b) preheating the portion of the mold containing the pour cup, gating (passages from the pour cup to the integral ring), blade ring pattern, and grain bridges (passages from the blade ring pattern to the seed crystals) to a temperature above the liquidus of the single crystal alloy; during preheating the chilled surface of the superalloy seed crystals is maintained at a temperature below the solidus temperature of the metal; and,

(c) casting into the investment casting mold molten superalloy at a temperature above the liquidus temperature of the metal;

(d) establishing a thermal gradient, such that temperature increases from said superalloy seed crystals through said molten metal;

(e) moving the thermal gradient vertically through the mold to directionally solidify the superalloy within the integral ring in the axial direction;

(f) removing the ceramic mold gates and risers;

(g) inserting the disk into the integral ring;

(h) diffusion bonding the ring of single crystal turbine airfoils to the superalloy disk;

(i)heat treating the blisk at temperatures lower than the diffusion bonding temperature; and

(j) machining the blisk to final dimensions.

36. The method of claim 35, wherein step (f) further comprises shrink fitting the disk into the integral ring, braze sealing the integral ring-disk interfaces that are outside of a final machining envelope, and hot isostatic pressing.

37. The method of claim 35, wherein the secondary [001] crystallographic orientation of the airfoils is vertical (approximately parallel to the integral ring axis) to maximize casting yield.

38. The method of claim 35, wherein the superalloy comprises 61.41 weight percent nickel, 9.3 weight percent cobalt, 5.0 weight percent chromium, 8.6 weight percent tungsten, 4.5 weight percent tantalum, 0.7 weight percent molybdenum, 3.0 percent rhenium, 5.7 weight percent aluminum, 0.7 weight percent titanium, 1.0 weight percent hafnium, 0.07 weight percent carbon, 0.015 weight percent boron, and 0.005 weight percent zirconium.